HUMAN SPACE FLIGHT

FY 2003 ESTIMATES

BUDGET SUMMARY

OFFICE OF SPACE FLIGHT | **SPACE STATION**

SUMMARY OF RESOURCE REQUIREMENTS

	FY 2001 OP PLAN REVISED	FY 2002 INITIAL OP PLAN	FY 2003 PRES BUDGET	Page Number
	(Millions of Dollars)			
Vehicle	751.9	369.1	292.3	HSF 1-5
Operations Capability	824.7	1,312.6	1,199.8	HSF 1-11
[Construction of Facilities included]	[0.3]	[5.0]	--	
Research *	457.4	[371.3]	[347.2]	HSF 1-20
Russian Program Assurance	24.0	--	--	HSF 1-21
Crew Return Vehicle	69.8	40.0	--	HSF 1-23
Total	2,127.8	1,721.7	1,492.1	

Distribution of Program Amount by Installation

	FY 2001	FY 2002	FY 2003
Johnson Space Center	1,549.5	1,500.5	1,162.9
Kennedy Space Center	113.2	97.0	95.3
Marshall Space Flight Center	288.9	75.1	61.9
Ames Research Center	61.5	0.2	0.2
Langley Research Center	4.1	0.1	0.1
Glenn Research Center	71.0	3.8	4.2
Goddard Space Flight Center	13.0	2.5	--
Jet Propulsion Laboratory	13.8	--	--
Dryden Flight Research Center	6.2	1.0	--
Stennis Space Center	--	--	--
Headquarters**	6.6	41.5	167.5
Total	2,127.8	1,721.7	1,492.1

* The International Space Station Research program and funding was transferred to the Biological and Physical Research (BPR) enterprise, beginning in FY 2002 and now is included in the Science, Aeronautics and Technology appropriation account. FY 2002 and 2003 funding is shown for comparison purposes only on a non-add basis.

** Headquarters funding in FY 2002-2003 consists largely of program reserves that will ultimately be provided to the performing centers.

STRATEGIC PLAN LINKAGE TO THIS BUDGET

The mission of the HEDS is to expand the frontiers of space and knowledge by exploring, using, and enabling the development of space for human enterprise. The Space Station program plays a vital role meeting the following goals: Goal 1 - Explore the space frontier; Goal 2 – Enable humans to live and work permanently in space; Goal 3 – Enable the commercial development of space; and Goal 4 – Share the experience and benefits of discovery.

The International Space Station (ISS) is a complex of research laboratories in low Earth orbit in which American, Russian, Canadian, European, and Japanese astronauts are conducting unique scientific and technological investigations in a microgravity environment. The goal of the Station is to support scientific research and other activities requiring the unique attributes of humans in space and establish a permanent human presence in Earth orbit. The President's Budget request provides funding for continued development of the vehicle and for operations in support of continued assembly, logistics resupply, crew exchange, research operations and other utilization. With nine assembly missions successfully completed, the budget includes funding to keep subsequent assembly missions on schedule through U.S. Core Complete (Flight 10A), currently planned for calendar year 2004, to support early research commensurate with the build-up of on-orbit utilization capabilities and resources.

The ISS will vastly expand the human experience in living and working in space, encourage and enable commercial development of space, and provide a capability to perform unique, long duration, space-based research in cell and developmental biology, plant biology, human physiology, fluid physics, combustion science, materials science and fundamental physics. ISS will also provide a unique platform for making observations of the Earth's surface and atmosphere, the sun, and other astronomical objects. The experience and dramatic results obtained from the use of the ISS will guide the future direction of the Human Exploration and Development of Space (HEDS) Enterprise. The International Space Station is critical to NASA's ability to fulfill its mission to explore, use, and enable the development of space for human enterprise.

The ISS represents an unprecedented level of international cooperation. Space Station Partnership agencies include NASA, the Russian Aviation and Space Agency (Rosaviakosmos), the Canadian Space Agency (CSA), the European Space Agency (ESA), and the National Space Development Agency of Japan (NASDA). Additionally, there are several bilateral agreements between NASA and other nations such as Italy and Brazil, resulting in a total number of fifteen U.S. international partners. International participation in the program has significantly enhanced the capabilities of the ISS.

Extensive coordination with the user community is well underway, and payload facilities development and research and technology activities are coordinated with the Office of Biological and Physical Research (OBPR), the Office of Earth Science (OES) and the

Office of Space Science (OSS). OBPR gained administrative responsibility for the ISS Research program starting in FY 2000, and, as required by both the Authorization Act (PL 106-391) and the 2002 Appropriations Act (HR 2620), the ISS research budget is transferred to the Office of Biological and Physical Research (OBPR) in FY 2002. The remaining ISS budget supports operations and completion of the U.S. core complete and allows the program to press ahead with the integration of the partners' research modules. A NASA cost estimate, and an independent cost estimate (ICE) of the cost to assemble and operate the U.S. core complete will be completed by September 2002. The 2002 appropriation directed a general reduction in the station budget of $75M, which eliminated reserves fenced for guaranteed carryover into 2003. The appropriation also earmarked $40M for X-38 efforts that was originally planned to cover X-38 plus continued work on Node 3 and the advanced environmental control system. NASA plans to fund the Node 3 and environmental control work into the 2nd quarter of 2002, when a decision will be made to continue those efforts or to cancel them.

In early calendar year 2001, NASA launched the U.S. Laboratory and the first major set of U.S. research equipment necessary for conducting experiments on the Space Station. Subsequent flights enabled the installation of the Canadian robotic arm, additional research equipment for the U.S. laboratory, installation of the Russian docking compartment, and transport of the 3rd and 4th crew expeditions. By mid-calendar year 2001, the U.S. Airlock had been installed, allowing spacewalks to be conducted without the Space Shuttle present, and marking completion of Phase 2 of the station assembly. The first utilization flight in December 2001 greatly expanded the number of research payloads on-orbit, and raised the number of research investigations initiated to over 40. Crew training, payload processing, hardware element processing, and mission operations were supported without major ground anomalies, and all but two on-orbit subsystems performed above predicted levels, resulting in a lower than expected maintenance work load. This lower maintenance workload, coupled with the commitment of the expedition crews to dedicate time for conducting research experiments, resulted in research activities that exceeded expectations. During 2002, 3 of the major truss elements constituting the power block will be deployed to orbit, Expeditions 5 and 6 will be deployed, and a second utilization flight will expand science capabilities even further. In calendar year 2003, activation of the thermal system will be completed, two of the three remaining solar array modules will be deployed, and both the S6 truss and Node 2, the final components of the U.S. Core, should be delivered to NASA for final integration and pre-flight test and checkout to support planned launches in calendar year 2004.

Consistent with the recommendations in the ISS Management and Cost Evaluation (IMCE) Task Force, and direction from the Administration, NASA will develop a Cost Analysis Requirements Description (CARD) to support cost estimates of the U.S. core complete baseline. NASA will also develop an integrated management action plan based on recommendations of the IMCE Task Force, and begin implementation of those actions. NASA will also report to the Administration and to Congress its plans for a non-governmental organization (NGO) for ISS research, and the results of discussions with the International Partners on ways to increase on-orbit resources for station research, in particular innovative methods for increasing crew availability. The ISS Program is pressing ahead with final flight hardware deliveries, and completion of the current Prime contract in December 2003. Requirements for follow-on support are being reviewed and estimated, and a plan to competitively award contracts for the station's operations phase will be released this Spring.

COMPLIANCE WITH COST LIMITATIONS

NASA's evaluation of this budget is that the Space Station is within the $25 billion cost limitation imposed in the NASA Authorization Act of 2000 (P.L. 106-391), and that the Space Shuttle flights supporting the ISS are within the $17.7 billion cost limitation imposed by that Act. This is based on the assumption that the point at which substantial completion will be reached will occur in FY 2004 when the U.S. Core capability is reached. Total Space Station program from FY 1994 through FY 2004 is projected at $23.4 billion in this budget (values are based on direct program budgets, including the ISS Research budgets in the Biological and Physical Research enterprise). Approximately 23 Shuttle flights are projected to be required to reach this point (Flight 10A), and another 9 flights to support ISS logistics and the assembly flights of the international partners' elements. Based on the $380 million per flight valuation in H.R. 1654, the value of 32 Shuttle flights is approximately $12.2 billion. Of the $17.919 billion appropriated for space station activities from FY 1994 through FY 2001, only $115 million remained unobligated as of September 30, 2001, and these funds are expected to be obligated in the course of FY 2002 ISS performance. A separate report required by the Act will be prepared and submitted.

BASIS OF FY 2003 FUNDING REQUIREMENT

VEHICLE

	FY 2001	FY 2002	FY 2003
Flight hardware	702.0	318.7	250.0
Test, manufacturing and assembly	47.5	50.4	42.3
Transportation support	2.4	--	--
Total	751.9	369.1	292.3

DESCRIPTION/JUSTIFICATION

Vehicle development of the International Space Station (ISS) provides an on-orbit, habitable laboratory for science and research activities, including flight and test hardware and software, flight demonstrations for risk mitigation, facility construction, Shuttle hardware and integration for assembly and operation of the station, mission planning, and integration of Space Station systems.

Responsibility for providing Space Station elements is shared between the U.S. and our international partners from Russia, Europe, Japan, and Canada. The U.S. elements include nodes, a laboratory module, airlock, truss segments, photovoltaic arrays, three pressurized mating adapters, unpressurized logistics carriers, and a cupola. Various systems are also being developed by the U.S., including thermal control, life support, navigation, command and data handling, power systems, and internal audio/video. The U.S. funded elements also include the Zarya propulsion module provided by a Russian firm under the Boeing prime contract. Zarya was the first ISS element launched to orbit. Other U.S. elements being provided through bilateral agreements include the pressurized logistics modules provided by the Italian Space Agency, Nodes 2 and 3 provided by ESA, and the centrifuge accommodation module (CAM) and centrifuge provided by the Japanese.

Canada, member states of ESA, Japan, and Russia are also responsible for providing a number of ISS elements. The Japanese, ESA, and Russia will provide laboratory modules. Canada will provide a remote manipulator system, vital for assembly and maintenance of the station. The Russian Aviation and Space Agency (Rosaviakosmos) is also providing significant ISS infrastructure elements including the Service Module (SM), science power platform, Soyuz crew transfer and emergency crew return vehicle, Progress resupply vehicles, and universal docking modules.

FY 2001 activities established a permanent crew on the ISS, deployed the first U.S. solar array to provide power, launched and activated the U.S. Lab, including the capability for control and communication, and deployed the airlock, completing Phase 2 of the program and allowing spacewalks to be conducted without the Space Shuttle present.

The Boeing Company is the prime contractor for the design and development of U.S. elements of the International Space Station. It also has prime responsibility for integration of all U.S. and International Partner contributions and for assembly of the ISS. At their Huntington Beach site location (formerly McDonnell Douglas), Boeing is developing and building the integrated truss segments that support station elements and house essential systems, including central power distribution, thermal distribution, and attitude control equipment. Additionally, major components of the communications and data handling, thermal control, and the guidance, navigation and control subsystems are being developed at Huntington Beach.

U.S. pressurized modules were developed by Boeing at their Huntsville site location, and by ESA. Flights to ISS have successfully deployed Unity, a pressurized node which contains four radial and two axial berthing ports, three pressurized mating adapters (PMAs), which serve as docking locations, the U.S. Laboratory Module and the Multi-Purpose Pressurized Logistics Module. Under a bilateral agreement, ESA is providing Nodes 2 and 3 and a cupola to the U.S. Node 2 is currently manifested for flight during the second quarter of FY 2004. The remaining elements are under discussion with ESA in the context of the Core Complete configuration.

The power truss segments and power system, essential to the Station's housekeeping operations and scientific payloads, are being built by Boeing at their Canoga Park location (formerly Rocketdyne Division, Rockwell International). Four photovoltaic (PV) elements, each containing a mast, rotary joint, radiator, arrays, and associated power storage and conditioning elements, comprise the power system. The first PV element was deployed in November 2000 and is successfully operating. The launch date for the fourth power array was accelerated and is now part of the U.S. Core configuration, planned as early as the second quarter of FY 2004.

The vehicle program also includes test, manufacturing and assembly support for critical NASA center activities and institutional support. These “in-line” products and services include: test capabilities; the provision of government-furnished equipment (GFE) (including flight crew systems, environment control and life support systems, communications and tracking, and extravehicular activity (EVA) equipment); and engineering analyses. As such, they support the work of the prime contractor, its major subcontractors and NASA system engineering and integration efforts.

Transportation support provides those activities that allow the Space Shuttle to dock with the Space Station. This budget funded the development and procurement of two external Shuttle airlocks, and upgrade of a third airlock to full system capability, which were required for docking the Space Shuttle with the Russian Mir as well as for use with the Space Station. Other items in this budget included: the Shuttle Remote Manipulator System (RMS) and Space Shuttle mission training facility upgrades; development of a UHF communications system and a laser sensor; procurement of an operational space vision system; procurement of three docking mechanisms and Space Station docking rings; EVA/Extravehicular Mobility Units (EMU) services and hardware; and integration costs to provide analyses and model development.

In order to ensure that the Space Station budget remains within the President’s five-year budget plan, funds for U.S. elements after U.S. core complete (flight 10A in the planned assembly sequence) have been redirected to address cost growth in the program. NASA is continuing program assessment activities, implementing management actions, and supporting an independent cost estimate that will seek to reduce the projected growth in cost estimates. Future decisions to develop and deploy additional U.S.

elements or enhancements beyond U.S. core complete will depend on NASA's success at demonstrating implementation of management actions as well as the quality of cost estimates, resolution of technical issues, and the availability of funding through efficiencies in Space Station or other Human Space Flight programs and institutional activities.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported:

Goal 2: Enable humans to live and work permanently in space

Strategic Plan Objectives Supported:

Objective: Operate the International Space Station to advance science, exploration, engineering, and commerce

Performance Plan Metrics Supported:

1H10: Successfully complete the majority of the planned development schedules and milestones required to support the Multi-Element Integration Testing

1H11: Successfully complete the majority of the ISS planned on-orbit activities such as delivery of mass to orbit and enhanced functionality

2H10 & 3H11: Demonstrate ISS on-orbit vehicle operational safety, reliability, and performance

2H11 & 3H12: Demonstrate and document the ISS program progress and readiness at a level sufficient to show adequate support of the assembly schedule

Milestones	FY 03 Budget Date	FY 02 Budget Date	Baseline Date	FY02-FY03 Change	Comment
Flt UF1 (MPLM)	12/01	11/01	10/98	+1 mos.	Impact of minor delays in Summer-Fall 2001
Flight 8A (SO Truss)	3/02	1/02	9/98	+2	Impact of minor delays in Summer-Fall 2001
Flt 9A (S1 Truss)	8/02	5/02	12/98	+2	Impact of minor delays in Summer-Fall 2001
Flt 11A (P1 Truss)	9/02	10/02	8/99	-1	Moved prior to ULF-1 flight
Flt 12A (P3/P4 PVAs)	4/03	12/02	10/99	+4	Minor 2001 delay impact, reduced FY 2003 flight rate
Flt 13A (S3/S4 PVAs)	8/03	4/03	12/99	+4	Minor 2001 delay impact, reduced FY 2003 flight rate
Flt 15A (S6 PVAs)	1/04	3/06	12/00	-26	4^{th} photovoltaic array launch planned acceleration
Flt 10A (Node 2) U.S. Core Complete	2/04	11/03	6/99	+3	Minor 2001 delay impact, reduced flight rate, minor resequencing

Lead Center: JSC	**Other Centers: MSFC, KSC, GRC, LaRC, ARC, DFRC &JPL**	**Interdependencies:** Canada, European Space Agency (ESA) member states, Japan, Russia; Italy and Brazil
Major Instruments/Subsystem	**Builder**	
Truss Structures, Pressurized Mating Adapters, Comm & Tracking, C&DH, External Thermal Control Node	Boeing Huntington Beach, CA	With completion of Phase 2 of the ISS, the vehicle is a fully functional, autonomous spacecraft. Subsequent flight in FY 2002 through FY 2004 will continue to build-out the on-board systems and capabilities.
US Lab Module, Life Supt. Sys.	Boeing Huntsville, AL	
Primary Electrical Power System	Boeing Canoga Park, CA	
Program Integration, Software	Boeing Houston	
Launch Vehicle: **Shuttle for U.S. elements**	**Tracking/Comm:** TDRS	**Data:** TDRS

PROGRAM STATUS/NOTIFICATIONS PLANS THROUGH 2002

- Flight 3S: The launch of Soyuz flight 3S in October 2001.
- Flight 6P: The launch of Russian Progress logistic flight 6P in November 2001.
- Flight UF-1, the first U.S. utilization flight mission, carried the MPLM "*Rafaello*" in December 2001, and performed a crew exchange (Expedition #4).
- Flight 8A scheduled for March 2002 launch, carrying S0 truss.
- Flight UF-2 scheduled for May 2002 launch, the second U.S. utilization flight carrying an MPLM, performing crew exchange (Expedition #5).
- Flight 9A scheduled for August 2002 launch, carrying S1 truss and 3 radiators.
- Flight 11A scheduled for September 2002 launch, carrying P1 truss and 3 radiators.
- Soyuz flight 4S, Progress flights 7P, 8P & 9P.
- Completion of Multi-Element Integrated Test (MEIT2) conditions for flight elements required for assembly flights 8A through 12A.

- Final integration and testing of truss segments P3/P4 and S3/S4 with their solar arrays for construction of the outboard truss in FY 2003.

- Demonstration of station-based EVA to support EVA's from the U.S. Airlock.

- Conduct permanent on-orbit operations, providing an estimated 8,000 hours of ISS crew support to station assembly, operations, and research.

PROGRAM PLANS FOR FY 2003

- Flight hardware assembly of truss segments P3/P4 and S3/S4, planned for April 2003 and August 2003.

- ULF-1 (utilization and logistics) flight in January 2003.

- Flight 12A.1, logistics flight, including P5 truss assembly in May 2003.

- Start of Multi Element Integrated Test (MEIT3) for flights 10A and 1J.

- Conduct permanent on-orbit operations and research.

SPACE STATION VEHICLE FUNDING DATA ($ in millions)

	FY94-00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	BTC	TOTAL
FY 2003 President's Budget	10,518.2	751.9	369.1	292.3	105.8	58.2	27.9	17.7		12,141.1
Flight Hardware	9,213.4	702.0	318.7	250.0	157.9	84.0	50.6	17.7		10,794.3
Test, Manufacturing & Assembly Supt.	423.1	47.5	50.4	42.3						563.3
Transportation Support	411.6	2.4								414.0
Flight Technology Demo	43.2									43.2
Program Management Support/Other	426.9									426.9
Savings to be realized *					-52.1	-25.8	-22.7			-100.6
[Estimated Civil Servant FTE]		[830]	[745]	[650]	[591]	[165]	[141]	[134]		

* Savings to be realized: Current ISS funding is based on realization of savings to baseline Vehicle and Operations estimates, while maintaining the U.S. Core capability and reserve funding levels. Vehicle allocation is estimated; actual will be subsequently determined.

Among the estimated savings in FY 2004-2006:

- Rates reductions from contract consolidation and workforce distribution -- $90 million.
- Flight integration & processing savings -- $140 million.
- Savings from prospective process re-engineering -- $330 million.

It is critical to act on these, and other areas, in order to realize reductions and ensure compliance with the President's budget. Assessments and studies of these areas are actively underway to validate reduction estimates. Targets will be incorporated in budget guidance to the performing centers. Consideration of the impact of reductions and savings will be made in conducting an internal cost estimate in Spring 2002, and in the independent cost estimate due to be completed in September 2002.

BASIS OF FY 2003 FUNDING REQUIREMENT

OPERATION CAPABILITY

	FY 2001	FY 2002	FY 2003
Operations capability & construction	45.0	28.0	22.6
Vehicle operations	352.5	779.6	675.1
Ground operations	427.2	505.0	502.1
[Construction of Facilities included]	[0.3]	[5.0]	
Total	824.7	1,312.6	1,199.8

DESCRIPTION/JUSTIFICATION

The first crew was launched to the ISS in October 2000. From this point forward, a progression of international crews will permanently inhabit the ISS. The logistics of providing the crew with what is needed for them to live and productively work in the isolated and harsh environment of space for 24 hours a day, 365 days per year is now a nominal part of ISS activities. The ISS assembly period will span half a decade, with infrastructure and logistics deployed over multiple flights from launch vehicles across the globe. Because of the program's complexity, the Space Station team has done extensive planning for operations of several different ISS vehicle configurations on-orbit. Each time an element is added to the current Station, the flight characteristics and internal systems change, and the ISS stack on-orbit becomes a different vehicle with different thermal constraints and drag coefficients. The Space Station Program is drawing on the experience derived from Skylab, the Shuttle-Mir program, and that gained from operating the Space Shuttle for nearly two decades to address the unique circumstances of building and operating an ever-changing vehicle.

The operations concept emphasizes multi-center and multi-program cooperation and coordination. Operations capability and construction provides the development of facilities, systems, and capabilities to conduct the operations of the Space Station. For the U.S. segment, the current and future operations development work will primarily be performed at the Johnson Space Center (JSC); facilities, systems, and capabilities were also developed at the Kennedy Space Center (KSC) as well as at JSC. KSC has developed launch site operations capabilities for conducting pre-launch and post-landing ground operations. JSC has developed space systems operation capabilities for conducting training and on-orbit operations control of the Space Station. As ISS partners become operational, their respective ground operations functions will be integrated by NASA into the unified command and control architecture. The Mission Control Center-Houston (MCC-H) is the prime site for the planning and execution of integrated system operations of the Space Station. Communication links from both Mission Control Center-Moscow (MCC-M) and MCC-H will support control activities, using the Tracking and Data Relay Satellite system (TDRSS) system and Russian communication assets.

Space Station vehicle operations provides systems engineering expertise and analysis to sustain the performance and reliability of Space Station hardware and software systems, spares provisioning, maintenance and repair, and operations planning and cargo integration. Engineering has been consolidated under the Integration and Operations (I&O) segment of the prime contract, performed at the Johnson Space Center (JSC). Part of the contract restructuring accomplished in 2000-2001, I&O activities, including multi-element integration testing, have been fully transitioned from the ISS vehicle budget to the operations budget in FY 2002. Maintenance and repair costs continue to be minimized by the application of logistics support analysis to the design, resupply/return and spares procurement processes. Flight hardware spares and repair costs will continue to be controlled by establishing a maintenance and repair capability including hardware depots that effectively utilize Kennedy Space Center (KSC) and original equipment manufacturers or other certified industry repair resources.

Ground operations provides training, mission control operations, operations engineering support, launch site processing, and center and enterprise program support. Flight controllers are trained to operate the Space Station as a single integrated vehicle, with full systems capability in the training environment. Crewmembers are trained in the Neutral Buoyancy Lab (NBL) and Space Station Training Facility (SSTF) on systems, operations, and other activities expected during a mission. Engineering support provides ground facility requirements and test support, ground display and limited applications development, resource planning, station/shuttle integration, crew systems and maintenance, extravehicular activity (EVA), photo/TV training, operations safety assessments, medical operations tasks, and mission execution and systems performance assessment. Launch site processing includes requirement definition and processing planning, post delivery inspection/verification, servicing, interface testing, integrated testing, close-outs, weight and center of gravity measurement, and rack/component to carrier installation.

The primary objective of the operations program is to safely and reliably assemble, activate, integrate, and operate the ISS. This requires a significant level of planning, coordination, and execution. Most of the hardware engineering, manufacturing, and testing – leading to the final acceptance and launch of the ISS elements – have successfully been completed. As these final components are integrated on the ISS, the program is transitioning into the operations phase. A detailed integration of the capabilities and constraints between ISS elements and ground systems is occurring across the partnership to ensure that the pieces and the people operate as one system. Additionally, ground controllers and the ISS crew continue to train for nominal and off-nominal activities.

The secondary goal of the operations program is to perform operations in a simplified and affordable manner. To do this, operational procedures/processes are constantly being evaluated – and in many cases streamlined – to improve efficiency. The program has also adopted a ‘Distributed Operations’ baseline. With this, each International Partner is responsible for integrating and operating their own elements. This greatly simplifies ISS operations.

LINKAGES TO STRATEGIC AND PERFORMANCE
Strategic Plan Goal Supported:
Goal 1: Explore the space frontier
Goal 2: Enable humans to live and work in space
Goal 3: Enable the commercial development of space
Goal 4: Share the experience and benefits of discovery

Strategic Plan Objectives Supported:
Objective: Conduct engineering research on the ISS to enable exploration beyond Earth orbit
Objective: Operate the International Space Station to advance science, exploration, engineering, and commerce
Objective: Meet sustained space operations needs while reducing costs
Objective: Improve the accessibility of space to meet the needs of commercial research and development
Objective: Foster commercial endeavors with the International Space Station and other assets
Objective: Provide significantly more value to significantly more people through exploration and space development efforts

Performance Plan Metrics Supported:
1H10: Successfully complete the majority of the planned development schedules and milestones required to support the Multi-Element Integration Testing
1H11: Successfully complete the majority of the ISS planned on-orbit activities such as delivery of mass to orbit and enhanced functionality
1H12: Successfully complete the majority of combined ISS planned operations schedules and milestones as represented by permanent human on-orbit operations
2H10 & 3H11: Demonstrate ISS on-orbit vehicle operational safety, reliability, and performance
2H11 & 3H12: Demonstrate and document the ISS program progress and readiness at a level sufficient to show adequate support of the assembly schedule
2H12 & 3H13: Successfully complete 90% of the ISS planned mission objectives
2H17: Provide an average of at least five mid-deck lockers on each Space Shuttle mission to the International Space Station
2H19: Develop and execute a management plan and open future Station hardware and service procurements to innovation and cost-saving ideas through competition, including launch services and a Non-Government Organization for Space Science Research
2H24 & 3H22: Expand public access to HEDS missions information (especially ISS) by working with industry, academia, and the media to create media projects and public engagement initiatives that allow “first-hand” public participation using telepresence for current missions, and virtual reality or mock-ups for future missions beyond Earth orbit
3H02: Provide for science and technology research on the ISS a minimum average of five mid-deck lockers for each Space Shuttle mission to the ISS and maintain 80% availability of Space Station resources to support science and technology research
3H15: Develop and execute a management plan and open future Station hardware and service procurements to innovation and cost-saving ideas

SCHEDULE & OUTPUTS

Prior to each mission or the start of an increment a series of reviews, Increment Operations Reviews (IOR) and Certificate of Flight Readiness Reviews (CoFR), are conducted to ensure readiness. These reviews are held according to a "launch minus" template with dates driven by major milestones such as final installation of cargo into the Shuttle. Below are a summary table of reviews conducted in 2001 and a table of reviews planned in 2002 and 2003.

2001 reviews conducted

	Flight	MRR or SCRR	LPRR (CoFR 1)	PRR	SORR (CoFR 2) (see note 1)	FRR (see note 1)	Launch	PFR	PIR
INC0	2A.2b/106		27-Jul-00	3-Aug-00	16-Aug-00	29-Aug-00	8-Sep-00	7-Dec-00	N/A
	3A/92	02-Jun-00	11-Aug-00	5-Sep-00	22-Sep-00	28-Sep-00	11-Oct-00	7-Dec-00	N/A
INC1	2R	26-Sep-00	N/A	N/A	12-Oct-00	19-Oct-00	30-Oct-00	N/A	25-Jan-01
	2P		N/A	N/A	16-Aug-00	N/R	16-Nov-00	N/A	N/A
	2P - Cont				Delta 9-Nov				
	4A/97	No MRR	2-Oct-00	7-Nov-00	9-Nov-00	17-Nov-00	30-Nov-00	14-Dec-00	N/A
	5A/98	No MRR	28-Nov-00	14-Dec-00	5-Jan-01	10-Jan-01	7-Feb-01	22-Feb-01	N/A
	3P		N/A	N/A	9-Feb-01	N/R	26-Feb-01	N/A	N/A
INC2	5A.1/102	20-Sep-00	26-Jan-01	13-Feb-01	9-Feb-01	27-Feb-01	8-Mar-01	22-Mar-01	26-Apr-01
	6A/100	20-Oct-00	13-Mar-01	29-Mar-01	27-Mar-01	5-Apr-01	19-Apr-01	3-May-01	N/A
	2S		N/A	N/A	27-Mar-01	N/R	28-Apr-01	TBD	N/A
	4P			N/A	27-Mar-01	N/R	20-May-0	N/A	N/A
	7A/104		1-May-01	7-May-01	18-May-01	28-Jun-01	12-Jul-01	26-Jul-01	N/A
	7A Delta				19-Jun-01				
INC3	7A.1/105		N/R	9-Jul-01		19-Jul-01	10-Aug-01	10-Aug-01	23-Aug-01
	5P			N/A		02-Aug-01	21-Aug-01	21-Aug-01	N/A
	4R	23-Aug-01		N/A		23-Aug-01	15-Sep-01	15-Sep-01	N/A

Note 1: Shaded boxes indicate Progress reviews were combined with the meetings for Shuttle or Soyuz flight.

Reviews planned for the next several increments

	Flight	Russian Assessment Review	LPA	PRR	SORR (CoFR 1&2) (see note 1)	FRR	Launch	PFR	PIR
	3S			N/A		02-Oct-01	21-Oct-01	21-Oct-01	TBD
	6P			N/A	30-Oct-01 A	N/R	26-Nov-01	N/A	
									7-Feb-02
INC4	UF1/108		09-Oct-01 A	23-Oct-01 A	30-Oct-01 A	15-Nov-01	5-Dec-01	13-Dec-01	
	7P			N/A	22-Jan-02	N/R	Feb-02	N/A	
	8A/110		18-Dec-01	TBD	26-Feb-02	7-Mar-02	Mar-02	4-Apr-02	
	4S			N/A	14-Mar-02	N/R	Apr-02	TBD	
									13-Jun-02
INC5	UF2/111		14-Mar-02	TBD	9-Apr-02	18-Apr-02	May-02	16-May-02	
	9A/112		23-May-02	TBD	18-Jun-02	27-Jun-02	Aug-02	25-Jul-02	
	11A/113		3-Jul-02	TBD	30-Jul-02	8-Aug-02	Sep-02	5-Sep-02	
									TBD
	5S		15-Jul-02	N/A	29-Aug-02	9-Sep-02	Oct-02	10-Oct-02	
	ULF-1		3-Oct-02		29-Oct-02	7-Nov-02	Jan-03	5-Dec-02	
	12A		5-Dec-02		30-Dec-02	9-Jan-03	Apr-03	6-Feb-03	
	6S		11-Feb-03	N/A	6-Mar-02	18-Mar-03	May-03	15-Apr-03	
									TBD
Note 1: Shaded boxes indicate Progress reviews will be combined with the meetings for a Shuttle or Soyuz flight.									

MRR- Mission Readiness Review, **SCRR**- Station Cargo Readiness Review, **LPRR**- Launch Package Readiness Review, **LPA**- Launch Package Assessment, **PRR**- Payload Readiness Review, **SORR**- stage Operations Readiness Review, **FRR**- Flight Readiness Review, **PFR**- Post Flight Review, **PIR**- Post Increment Review

FY 2001 ACCOMPLISHMENTS

The ISS is made up of thousands of components and dozens of complex systems. These systems are operated and monitored by flight controllers on the ground 24 hours a day, 365 days a year. As might be expected with such complex equipment, several of the components have not operated as planned. Strenuous simulations and challenging training prepared both the crew and ground controllers for the difficult tasks. Flight controllers have been able to isolate the problems and develop operational workarounds. Perhaps, the greatest successes in the ISS program are seen when the crew and ground controllers work together to solve problems that seem impossible to solve. Throughout 2001, the crew and ground controllers located at JSC and MSFC met each system or payload anomaly with a successful solution.

Operations provided the support for the numerous deliveries of flight hardware, crew and supplies that increased ISS capabilities and provided for its operational necessities.

Assembly flight 3A provided Z1 truss assembly, control moment gyros (CMGs), PMA3 – Oct-00.

Soyuz flight (2R) established the first permanent international crew, Expedition #1 – Oct-00.

Assembly flight 4A provided the P6 photovoltaic power assembly – Nov-00.

Assembly flight 5A (Feb-01) provided delivery and installation of the U.S. Destiny Laboratory onto the ISS including the following:

- Five racks of core system components that provide life-sustaining functions – such as electrical power, cooling water, data collection, air revitalization, and temperature/humidity control.
- Racks that house micro-gravity research, human life science, and fundamental biology experiments.
- 25 rack capacity
- Transfer of ISS lead operations from the Russian Mission Control Center to NASA's Mission Control Center in Houston.
- More habitable volume than Mir.

Assembly flight 5A.1 (Mar-01) provided the following elements and new capabilities:

- Delivery of new system racks containing electrical power and control equipment for the ISS robotic arm.
- Delivery of new payload racks.
- Delivery of new crewmembers (Expedition #2).
- Demonstrated capability of the Italian-built Multipurpose Logistics Module (MPLM).
- Delivery of the Human Research Facility (HRF) experiment, which demonstrated capability of the Payload Operations Center (POC), located at the MSFC. Additionally, Payload Developers (PDs) began supporting the POC from locations across the U.S..

Assembly flight 6A (Apr-01) delivered the following capabilities:

- Canadian built robotic arm (Canadarm2), successfully installed and checked-out on the ISS.
- Two payload experiment racks.

- Ultra-High Frequency (UHF) communications antenna.
- Spare electronics, and supplies

Assembly flight 7A (Jul-01) delivered the Joint Airlock, and marked the completion of Phase 2 of the ISS assembly.

- Allows the crew – using either Russian or American spacesuits – to perform space walks without a Shuttle being docked with the ISS.

Assembly flight 7A.1 (Aug-01) delivered the following to ISS:

- Payload experiments, including Materials International Space Station Experiments (MISSE) Project experiment, the first externally mounted experiments conducted on the ISS.
- Supplies
- installation of the Early Ammonia Servicer equipment to be used on future assembly flights.
- New crewmembers to the ISS (Expedition #3).

Other Flights:

- Four Russian Progress flights
- Two Soyuz (including 2R)

PROGRAM STATUS/NOTIFICATIONS PLANS THROUGH 2002

The ISS transformation into a world-class research facility will continue through 2002 and 2003. Payload racks loaded with experiments will be carried to the ISS several times throughout the period. As the number and complexity of experiments increases, the crew and ground controllers will spend more of the ISS resources conducting experiments onboard. The level of coordination between the Mission Control Center-Houston, the Payload Operations Center-Huntsville, and the Payload Developers will also become more complex.

Future flight crews and controllers on the ground will continue to utilize the training facilities developed for the program. The Space Station Training Facility (SSTF) – now fully functional – will continue to be a vital resource used in the ISS flight controller certification process. Using the SSTF, future ISS hardware/software configurations will be loaded into the system to mimic the actual ISS on-orbit configurations. Controllers will practice sending commands, configuring flight hardware, and developing operational procedures.

Using Artificial Intelligence (AI) and Knowledge Based (KB) systems, engineers at the Mission Control Center-Houston and the Payload Operations Center are exploring better ways of operating the Station. All processes and procedures are being analyzed to insure that all systems are operated efficiently and safely. These improved processes will be integrated into nominal and off-nominal operations procedures throughout the year. This is a part of NASA's commitment to Continuous Improvement (CI).

Operations will continue to provide support for the numerous deliveries of flight hardware, crew and supplies that increased ISS capabilities and provided for its operational necessities.

Five Shuttle flights to station during 2002 will provide three crew exchanges, supplies, critical spares and repairs, High Rate Communications Outage Recorder, central truss segment, right truss segment, left truss segment, Mobile transporter, Mobile Base System, and payload experiments:

- Flight UF-1, the first U.S. utilization flight mission, carried the MPLM "*Rafaello*" in December 2001, and performed a crew exchange (Expedition #4).

- Flight 8A scheduled for March 2002 launch, carrying S0 truss.

- Flight UF-2 scheduled for May 2002 launch, the second U.S. utilization flight carrying an MPLM, performing crew exchange (Expedition #5).

- Flight 9A scheduled for August 2002 launch, carrying S1 truss and 3 radiators.

- Flight 11A scheduled for September 2002 launch, carrying P1 truss and 3 radiators, performing crew exchange (Expedition #6).

<u>Other Flights</u>
Four Progress resupply flights to Station during 2002
Two Soyuz flights to Station during 2002

<u>Life Cycle Cost Data</u>
NASA is currently developing internal and independent Life Cycle Cost estimates per the IMCE task force (Young Commission) recommendations that will be complete by September 2002. See table below for budget estimates.

PROGRAM PLANS FOR FY 2003

Four Shuttle flights to station during 2003 will provide:

- Crew exchange- 2 crew exchanges are planned during the year
- Logistics- Critical spares and repairs
- Supplies
- Data Systems
- Payload Experiments
- Core components- second port truss segment, third port truss segment, second starboard truss segment, central cooling radiators, second and third sets of solar arrays, additional set of nickel-hydrogen batteries.

Other Flights:
Four Progress resupply flights to Station during 2003
Two Soyuz flights to Station during 2003

SPACE STATION OPERATIONS FUNDING DATA ($ in millions)

	FY94-00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	BTC	TOTAL
FY 2003 President's Budget	2,735.7	824.7	1,312.6	1,199.8	1,090.1	1,013.8	1,064.0	1,092.7	cont.	10,333.4
Operations Capability & Construction	835.9	45.0	28.0	22.6	25.3	3.7	2.7	1.6		964.8
Vehicle Operations	899.3	352.5	779.6	675.1	659.2	689.6	699.0	603.7		5,358.0
Ground Operations	1,000.5	427.1	505.0	502.1	494.8	489.3	487.9	487.4		4,394.1
Savings to be realized *					-89.2	-168.8	-125.6			-383.6
[Estimated Civil Servant FTE]		[674]	[913]	[865]	[947]	[1,380]	[1,376]	[1,408]		

* Savings to be realized: Current ISS funding is based on realization of savings to baseline Vehicle and Operations estimates, while maintaining the U.S. Core capability and reserve funding levels. Operations allocation is estimated; actual will be subsequently determined.

Among the estimated savings in FY 2004-2006:

- Rates reductions from contract consolidation and workforce distribution -- $90 million.
- Flight integration & processing savings -- $140 million.
- Savings from prospective process re-engineering -- $330 million.

It is critical to act on these, and other areas, in order to realize reductions and ensure compliance with the President's budget. Assessments and studies of these areas are actively underway to validate reduction estimates. Targets will be incorporated in budget guidance to the performing centers. Consideration of the impact of reductions and savings will be made in conducting an internal cost estimate in Spring 2002, and in the independent cost estimate due to be completed in September 2002.

BASIS OF FY 2003 FUNDING REQUIREMENT

Research

	FY 2001	FY 2002*	FY 2003*
Research Projects	288.4	[221.3]	[208.3]
Utilization Support	169.0	[150.0]	[138.9]
Total	457.4	[371.3]	[347.2]

***** The ISS Research program and funding was transferred to the Biological and Physical Research (BPR) enterprise, beginning in FY 2002 and now included in the Science, Aeronautics and Technology appropriation account, shown here for comparison purposes only on a non-add basis.

DESCRIPTION/JUSTIFICATION

The ISS is utilized as an interactive laboratory in space to advance scientific, exploration, engineering and commercial activities. As a microgravity laboratory, the ISS will be used to advance fundamental scientific knowledge, foster new scientific discoveries for the benefit of the U. S., and accelerate the rate at which it develops beneficial applications derived from long-term, space-based research. The ISS is a premier facility for studying the role of gravity on biological, physical and chemical systems. The program will deliver the capability to perform unique, long-duration, space-based research in molecular, cellular, comparative, and developmental biology, human physiology, biotechnology, fluid physics, combustion science, materials science and fundamental physics. The experience and knowledge gained from long-duration human presence on the ISS will help us learn how to more safely and effectively live and work in space. ISS also provides a unique platform for making observations of the Earth's surface and atmosphere, the sun and other astronomical objects, as well as the space environment and its effects on new spacecraft technologies.

At the beginning of FY 2002, this activity and funding was transferred to the Biological and Physical Research (BPR) enterprise. See the BPR International Space Station Research Capability Program (ISSRC) for further program description/justification, and current status, notifications, and plans for this budget.

BASIS OF FY 2003 FUNDING REQUIREMENT

Russian Program Assurance

	FY 2001	FY 2002	FY 2003
Russian Program Assurance	24.0	--	--

DESCRIPTION/JUSTIFICATION

NASA's approach to contingency planning has been to incrementally fund only those activities that permitted the United States to continue to move forward should the planned contributions of our ISS partners not be delivered as scheduled, rather than to assume the responsibilities of other ISS partners. Russian Program Assurance (RPA) funding provided contingency activities to address ISS program requirements resulting from potential delays or shortfalls on the part of Russia in meeting its commitments to the ISS program. These contingency activities were not intended to protect against the complete loss of Russian contributions. That impact would have caused an extended delay to the program, necessitating additional crew return, life support, reboost, and guidance and control capabilities to replace planned Russian contributions, and result in a significantly more costly and less robust space station.

For several years Russia experienced significant economic challenges resulting in the Russian Aviation and Space Agency (Rosaviakosmos) receiving only a fraction of its approved budget. These shortfalls resulted in schedule slips of the ISS hardware and operations support that Russia was responsible for funding and providing. To accommodate this shortfall, the U.S. developed a three step contingency plan and initiated specific developments to protect the ISS schedule and capabilities in the event of further Russian delays or shortfalls. In spring 1997, NASA embarked on the initial steps of a contingency plan to provide U.S. capabilities to mitigate the impact of further Russian delays. Step one consisted primarily of the development of an Interim Control Module (ICM), built by the U.S. Naval Research Laboratory for NASA, to provide command, attitude control, and reboost functions to provide a backup capability in the event the Russian Service Module was significantly delayed or not successfully provided. Over the next year further delays continued on the Russian elements. During summer 1998, NASA initiated activities to implement additional contingency plans to provide flexibility for the United States in the event of further Russian delays or shortfalls. These consisted primarily of development of a U.S. Propulsion Module, enhancing logistics capabilities, modifying the Shuttle fleet for enhanced Shuttle reboost of ISS, and procurement of needed Russian goods and services to support Russian schedules for the Service Module and early ISS Progress and Soyuz launches.

With the successful deployment of the Russian Service Module, and Russia's positive performance overall, NASA has reassessed its contingency plans, and determined that much of the Russian assurance efforts were no longer a priority relative to other program needs. Based on the increasing costs to planned RPA elements and the baseline program, and the reduced impact of future Russian non-performance, NASA placed the ICM in "call-up" mode in FY 2000. The ICM is stored at the Naval Research Lab while plans to remove NASA-owned components are implemented, and custody of the retrograde vehicle is transferred to the Navy. NASA expects the transfer to occur in the second quarter of FY 2002. In FY 2001, the Propulsion Module Project was ended, and most RPA funds were transferred to the Vehicle program. Remaining FY 2001 funds are reserved for Propulsion Module contract closeout, other contingency activities, and the potential procurement of safety-related Russian goods and services. A decision to implement the remainder of the RPA Program, or to request that remaining funds be reprogrammed to support baseline program needs, will be made after further consultation with the Administration and the Congress.

BASIS OF FY 2003 FUNDING REQUIREMENT

Crew Return Vehicle

	FY 2001	FY 2002	FY 2003*
X-38/Crew Return Vehicle	69.8	40.0	--

* FY 2002-2003 funding is currently under review and allocations to X-38/Crew Return Vehicle (CRV) will be determined as part of program assessments.

DESCRIPTION/JUSTIFICATION

The safety of the crew for the International Space Station is of critical importance. The Russian Soyuz vehicle provides a capability to return the crew from orbit if needed for life threatening emergencies that may arise on orbit. Continued sole reliance on a single Soyuz capability limits the crew size for the ISS and poses operational and programmatic impacts. Each Soyuz can only transport a crew of three and has to be changed out after about six months on orbit. A more capable crew return vehicle that overcomes the limitations of the Soyuz is the most desirable long-term approach for ensuring crew safety. A goal of the Crew Return Vehicle (CRV) project is to leverage the technologies, processes, test results, and designs developed in the preliminary technology development work carried out in the X-38 project and related contractor studies of a CRV.

The Crew Return Vehicle (CRV) project will initiate work towards an independent U.S. crew return capability for the ISS. The CRV would accommodate safe return for up to seven crew under the following scenarios:

- Crew member(s) ill or injured while the space shuttle orbiter is not at the station.
- Catastrophic failure of the station that makes it unable to support life and the space shuttle orbiter is not at the station or is unable to reach the station in the required time.
- Problem with the space shuttle that makes it unavailable to re-supply the station or change-out crew in a required timeframe.

NASA has funded the X-38 project to reduce the risk of developing a CRV. The X-38 design has a strong foundation from the lifting body research and technology developments carried out since the 1960's. The previous plan to transition from X-38 research and development to CRV design and development was comprised of the following phases:

- Phase 0 - An unfunded observation period in which contractors interact with the X-38 project team. This effort began 20 July 1998 and is now complete. Five companies participated in this phase which was performed with X-38 Advanced Projects funding.

- Phase 1a – Selected contractor(s) will perform delta design tasks to convert the X-38 design into an operational CRV design and participate in the X-38 flight test program as a part of CRV verification and validation. Phase 1a is fixed cost, runs for about 12 months and includes tasks and deliverables up through Preliminary Design Review and Interim Design Review.
- Phase 1b – After Phase 1a, one contractor will continue the CRV design development and test program support up through the X-38 vehicle 201 space flight test and CRV Critical Design Review. This phase will also be fixed cost and will last about 20 months.
- Phase 2a – This phase of CRV production is a cost-plus-incentive-fee contract for delivery of the first two operational CRVs, one of which will be a refurbished space flight test vehicle (201R). It is expected to last for about 24 months.
- Phase 2b – This phase is a fixed-cost contract for delivery of the third and fourth operational CRVs and is slated to run about 27 months.

These phases would have included three primary tasks:

- Perform delta design tasks necessary to convert the X-38 design into an operational CRV design, and perform necessary system integration internally and with STS and ISS.
- Support atmospheric and space flight tests of X-38 prototype vehicles as part of CRV validation.
- Perform production of the CRV operational vehicles.

As a result of cost growth on the ISS program, X-38/CRV funds were allocated back to the Space Station HSF budget to address this growth, these plans are not being pursued, and no Phase 1a contract was awarded. NASA will continue to assess the affordability of continued investment in the X-38/CRV relative to other program priorities. Future decisions to develop and deploy additional U.S. elements or enhancements beyond U.S. core complete, like the CRV, will depend on NASA's success at demonstrating implementation of management actions as well as the quality of cost estimates, resolution of technical issues, the availability of funding through efficiencies in Space Station or other Human Space Flight programs and institutional activities, and possible increased international partner participation in the CRV project in particular.

FY 2001 ACCOMPLISHMENTS

The X-38 project continued with atmospheric vehicle and parafoil flight-testing, and the space flight vehicle build as the prototype for the ISS Crew Return Vehicle (CRV). X-38 flight-testing has successfully demonstrated numerous technologies needed for the operational CRV. Among the more important of these is flight of the operational body shape and full operational scale parafoil, advanced flight control software, electro-mechanical actuators and laser activated pyrotechnics.

The first of two 80% scale atmospheric test vehicles, vehicle 131R, was modified to match the expected CRV production vehicle body shape and successfully completed its first free flight test in November of 2000. Free flight tests progressively match larger portions of the CRV operational reentry flight profiles to enhance performance validation as X-38 testing plays an important role in the overall CRV flight certification plan. Two more atmospheric flights are planned for this year.

In addition to the atmospheric flight test progress, several important X-38/CRV reviews were successfully completed. The Shuttle Payload Safety Review, the X-38 Entry Safety Review, the KSC Ground Safety Review, an Aerodynamics Peer Review and a Landing Site review were all completed with several minor issues cited but no significant issues identified.

Buildup of the space reentry flight unit X-38, vehicle 201, continued with subsystem integration and testing. Structural design changes to the X-38 flight unit Deorbit Propulsion Stage (DPS) were completed, all components were installed, and all acceptance tests were completed in preparation for delivery to NASA in the second quarter of FY02.

PROGRAM STATUS/NOTIFICATIONS PLANS THROUGH 2002

Thus far in FY 2002, the X-38/CRV project has successfully completed the eighth X-38 atmospheric flight test, further drogue parachute testing, multiple string subsystem power-up testing on the space flight reentry vehicle, the fourth flight of the INS/GPS navigation system (on Shuttle STS-108), and final transonic aerodynamics simulations at USAF facilities. Highlights of continuing work in FY 2002 include integration and testing of reentry vehicle subsystems, body flap aerothermal testing, full scale parafoil testing, full four string avionics power up testing on the space flight reentry vehicle, F-15 flight testing of the X-38 electro-mechanical actuators, reentry test vehicle structural tests, aerodynamic and aerothermal simulations and analyses, and two additional atmospheric flight tests. Additional work will include continued development of the CRV inertial guidance system (SIGI - System of Interactive Guidance and Information); avionics instrumentation; radiation-hardened computer system network elements; operating and flight system software; and communication system signal processors. Flight dynamics work will include simulation-based development and verification of the CRV flight controls. Mechanisms work would include verification of electro-mechanical actuators (EMAs) and laser pyros. Parafoil work will continue with testing, new parafoil procurements, and integrated structural dynamic modeling. Thermal Protection System component procurement will also continue.

Operations tasks include analyses of CRV separation (from Space Station) dynamics, continuing development of landing site and site selection requirements, and development of crew displays and controls requirements. Mission operations tasks include Mission Control Center and facility design requirements, modeling, and development of flight and ground procedures and flight rules. Logistics and maintenance tasks would focus on development of a spares program. Kennedy Space Center tasks include development of launch support and logistics flight operations requirements.

PROGRAM PLANS FOR FY 2003

No funding is being requested in this budget for X-38/CRV, however NASA is holding talks with our international partners regarding increased participation in X-38/CRV development and procurement as a part of ISS program reassessment and restructuring activities. In September 2002, NASA will be reporting on the results of these talks. In the event that X-38 work is carried into FY 2003, the FY 2002 tasks mentioned above would continue to mature - with possible international partner support.